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SUMMARY OF SUGGESTIONS BY NASA HEADQUARTERS PERSONNEL AS TO IDEAS THAT MAY HAVE APPLICATION TO THE WAR IN SOUTHEAST ASIA

1. Instantaneous Report of Cloud Cover.

The only high-resolution all-weather sensor that reconnaissance aircraft have at present is photographic equipment. Inasmuch as commanders do not want to risk planes or launch unproductive flights when clouds obscure the target area, it would be highly desirable to be able to obtain accurate and current information as to weather conditions over the target areas. An immediate solution could be provided by assembling a relatively inexpensive expendable system from existing components. This would utilize vidicon cameras developed for weather satellites, but flying them on sounding rockets from either ships or mobile launchers. The second, longer-term, approach to obtaining photos on call would be to use a weather satellite at synchronous altitude with a steerable zoom lens.

(ACTION BEING TAKEN: NASA Office of Space Science and Applications is preparing a memorandum which will identify the general characteristics of these and other systems that might be utilized for the collection of weather information using space developed technology. This memorandum will identify the time required to develop these systems and their approximate cost.)

2. Synchronous Altitude Communications Satellite.

There appears to be a severe problem in point-to-point communications in Southeast Asia. While the ground equipment would be too bulky and expensive for small units in the field, it appears that it may be practical to make use of an on-the-shelf ComSat Early Bird and place it over Viet Nam for reliable and relatively secure communications between major installations.

(ACTION BEING TAKEN: Office of Space Science and Applications is preparing a report which will summarize what might be accomplished, how long it would take, and how much it would cost.)

3. Armor for Pilots and Vital Parts of Aircraft.

Small arms ground fire apparently is accounting for a high percentage of aircraft losses in Viet Nam. It is possible that some of the NASA work on the problem of protection against micrometeorites might have application here.

(ACTION BEING TAKEN: Office of Advanced Research and Technology is querying our NASA Centers to see whether the work on laminates, and with special materials, may offer more effective protection per pound of weight than single sheets of conventional steel plate. If it appears that some of our work may be useful, we will forward a memo identifying individuals to be contacted for further details.)

4. Light-weight Electrical Power Source.

The aircraft inertial navigation system in use in the RF-4's and F-104's requires about 45 minutes to warm up and thoroughly stabilize. Since this time is rarely available, a very high percentage of the flights take off without this material being operational. The USAF has looked at lead-acid batteries and nickel-cadmium and found they are too heavy to carry about the aircraft. However, it is possible that silver cells or other high-capacity low-weight power sources developed for satellite applications might be used to keep this equipment warm while the aircraft is sitting on the field.

(ACTION BEING TAKEN: Office of Advanced Research and Technology will prepare a brief report as to their thoughts on how this problem might be solved.)

5. Mortar-delivered Radar Beacon.

Smoke flares are now used to mark ground targets but these are only visible to our pilots in clear weather. Also they may alert the enemy as to an impending air attack. A sub-miniature radar beacon which would operate for a few hours after impact -- even though it landed in mud or marshy ground -- would permit all-weather marking of targets and would not cause alarm.

(ACTION BEING TAKEN: JPL is preparing a detailed technical proposal covering the development and fabrication of a small number of evaluation units.)

6. Application of Seismic Detectors.

The super-sensitive seismometers developed for the early Rangers and the Surveyor may have a variety of applications when incorporated in systems for the detecting of truck convoys and personnel movements under jungle cover and/or at night.

(ACTION BEING TAKEN: JPL is preparing a proposal for the Air Force as to how these might be utilized in a perimeter alarm system to increase base security. However, since these units are small and very rugged, thought will be given to how they might be utilized in air drops through the jungle, as well as to how these devices might be used in fusing of bombs and mines.)

7. Use of Piezoelectric Crystals for Detection of Traffic.

This idea utilizes the property of crystals such as Rochelle salts to generate a large voltage when subjected to mechanical stress. The mode of operation would be to drop encapsulated crystals in great quantities in the expected path of Viet Cong traffic, or place them around a base or along a re-supply line. The crushing crystals by foot or by vehicle would then be sensed by appropriate radio receiving equipment.

(ACTION BEING TAKEN: JPL has been asked to conduct a very preliminary examination of the feasibility of this idea. Also the Lewis Research Center, because of its proximity to the Brush Instruments Division of Clevite Corporation, has been asked to solicit their views of the feasibility.)

8. Infrared Sensors.

Infrared scanning devices might be developed in temperature sensitivity to the point where they could detect the difference in radiation from a given piece of real estate with and without large numbers of Viet Cong present. High resolution infrared-type scanners can be built that are sensitive enough to detect human beings at 150 yards if the difference between the body temperature and the ambient is in the order of two degrees or more. The scanners could be carried by foot soldiers or dropped by parachute.

(No action under way at present.)

9. Expendable TV for Detection of Personnel.

Miniaturized and ruggedized vidicon cameras could be launched by rocket or perhaps even mortar for free-fall or parachute descent over suspected Viet Cong positions under actual combat conditions. Receiving equipment is available to record and replay in "still" format all of the pictures in a manner that is similar to the broadcasts to the networks at the time the last Ranger impacted the moon. Also vidicon camera systems could be located or dropped into jungle terrain with the expectation that a parachute or an umbrella-like wire frame would leave the camera suspended in the air beneath the tree foliage. Using "bug-eye" optics, the camera could continuously relay at a low bandwidth photographs of the surrounding situation.

(No action under way at present.)

10. Expendable Sonic Systems for Detection of Personnel.

Miniaturized and ruggedized microphones could be dropped into suspected Viet Cong jungle hide-outs to monitor sounds, including conversations, convoy movements, etc. Because of the dense foliage in some areas it seems likely that some of these devices could remain undetected for long periods of time.

The transmitters could operate on various frequencies to improve position fixing. Anti-submarine warfare aircraft may already have the equipment (sonobuoy dispensers, multi-frequency receivers, etc.) required to make use of these systems.

(No action under way at present.)

11. Extensible Platform for Sensors.

The extensible boom work being done by de Havilland Canada (for satellite applications) might be adapted to a very compact device which could quickly and easily raise vidicon cameras and other sensors above the jungle for surveillance. The boom could also be collapsed in a matter of seconds. This idea might also have some application to the erection of a radio antenna for portable communications stations.

(No action under way at present.)

12. Special Instrumentation for Detecting and Identifying Personnel.

Very sensitive techniques for detecting and uniquely identifying extremely small amounts of materials have been developed in the NASA bioscience program. These techniques use gas chromatography, mass spectrometry, and neutron activation. Progress has been made toward miniaturization of the detection instruments to a form which could be adapted for field use. These techniques are sufficiently sensitive and selective that they might be adapted to aircraft operation to analyze contamination in the air, to locate and identify ground activity by Viet Cong, e.g., detecting exhaust from combustion of petroleum products of Chinese-USSR origin. They might also be used to sort out unfriendly or friendly personnel who have been tagged either by intentional contact with material of Communist origin (e.g., gun lubricants) or by unintentional contamination of specific substances incident to their operations. This identification can be done by direct access to the personnel or by analyzing the air down-wind of the personnel.

(ACTION BEING TAKEN: NASA has been advised that some projects are already under way in the Military Services in these areas. We will be contacted so that the individuals who are doing this work may be brought together with NASA specialists to learn what contributions, if any, our instrumentation may make on this project.)

13. Protection of Air-dropped Materiel.

The Ranger balsa ball technique (either using balsa or other crushable materials such as foam plastic) might be useful in the free-fall dropping of supplies.

(No action under way at present.)

14. Sensitive Metal Detection Systems.

NASA's work in magnetometers as used in our interplanetary probes may permit an enhancement of current mine detecting devices to the point where they could detect personnel carrying small arms at some distance in the jungle.

(No action under way at present.)

15. High-intensity Flares.

A useful concept may be to consider the sowing of jump-up flare mines along supply routes. These would be designed to be triggered by passing vehicles only at night. Flare operation could be used as a visual signal for a bombing attack, and possibly even serve as a target for light-seeking glide bombs.

(No action under way at present.)

16. Device to Alert Pilot of Impending Missile Attack.

It should be relatively easy to make a sub-miniaturized receiver which would operate at the frequency of North Vietnamese fire control radars. Further discrimination could be provided by restricting the alarm system to function only when a signal of the appropriate PRF was received. This hearing-aid-sized device could be carried in a pocket in the flight suit, or even mounted on the pilot's helmet.

(ACTION BEING TAKEN: We suggested this at the time of a NASA Headquarters briefing on the S.A.M. problem. Subsequent information from Colonel Green, Headquarters USAF, indicates that several devices of this kind are already under development. Hence, no action is being taken by NASA. It is included here only for purposes of completing the record.)

17. Alarm System to Indicate to Pilot that S.A.M. Has Been Launched.

With relatively minor modification to the aircraft, it might be possible to mount an IR sensor to the under-surface of the plane in such a position that it is shielded from the aircraft's engines and exhaust but "looks" toward the ground and ahead. Circuitry which would detect the "signature" of the burning of the S.A.M. booster might be mounted in a standard aircraft panel instrument case. This alarm would indicate to the pilot that a missile has been launched and would give him several seconds to take evasive maneuvers.

(No action under way at present.)

18. Improved Mapping.

Steps should be taken to insure that the appropriate people in the Military Services are aware of the fact that GEOS is in orbit and that

this may offer some additional help in improving mapping and for tying reconnaissance photographic data into maps.

(No action under way at present.)

19. Use of Satellites in Air Crew Rescue.

A low-flying satellite could be used for appeals for help and location and rescue of lost or downed aircraft crews by an inverse TRANSIT technique. This would require only a very simple transmitter. It could be followed up by a helicopter using homing operations on the same transmitter.

(No action under way at present)

20. Application of Possible Medical Interest in Space Diets.

Low residue food might be helpful in feeding abdominal injury cases.

(No action under way at present.)

21. Possible Application of Space Suit Technology.

NASA has done considerable work in developing multi-layer suits for extra-vehicular activity in space. These provide a high degree of physical protection but are still relatively flexible. Some application of these materials might help provide physical protection to downed pilots in saw grass and other hazardous terrain.

(No action under way at present.)

22. Short-range IR Communications Links.

Flashlight-sized devices can be used to communicate over line-of-sight distances on the ground over a few hundred yards using modulated IR light beams.

(No action under way at present.)

23. Potential Missile Defense Systems.

If and when S.A.M.'s are used in North Viet Nam which employ IR seekers, the combination of water discharge into the jet engine tail pipe, combined with dropping of one or more flares, may succeed in "unlocking" the missile homing system from the jet sufficiently long enough for it to pick up the flare instead.

(No action under way at present.)

24. Unorthodox Vehicles.

Both the Surveyor lunar roving vehicle project at the JPL and the MOLAB project at Marshall Space Flight Center have investigated new concepts in off-the-road locomotion. Information derived from the development and tests of models of these vehicles might have application to the design of rough ground vehicles for the Military.

(No action under way at present.)

25. Special Tankage.

Titanium alloy material such as the 6A14V titanium used for the Surveyor propellant tanks and gas bottles might be employed for the fabrication of light-weight high-strength tanks used in mobile applications. This material could be utilized both for high pressure and corrosive material applications.

(No action under way at present.)

26. Zero-zero Weather Landings of Helicopters.

The data and know-how resulting from research and development work on the radar altimeter and Doppler velocity sensor techniques for lunar soft-landings by the Surveyor spacecraft and the Lunar Excursion Module might be helpful in solving the problem of zero-zero weather landings of helicopters, possibly even fixed-wing aircraft.

(No action under way at present.)